Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Thursday 16 November 2023

Morning (Time: 2 hours)

Paper reference 4PH1/1P 4SD0/1P

Physics

UNIT: 4PH1
Science (Double Award) 4SD0
PAPER: 1P

You must have:
Ruler, calculator, Equation Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

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FORMULAE

You may find the following formulae useful.

energy transferred = current × voltage × time $\qquad E = I \times V \times t$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

$(\text{final speed})^2 = (\text{initial speed})^2 + (2 \times \text{acceleration} \times \text{distance moved})$

$$v^2 = u^2 + (2 \times a \times s)$$

pressure × volume = constant $\qquad p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 This question is about astrophysics.

(a) Which of these is a large collection of billions of galaxies?

(1)

☒ **A** Milky Way

☒ **B** nebula

☒ **C** solar system

☒ **D** universe

(b) Which of these is a correct unit for gravitational field strength, *g*?

(1)

☒ **A** kilogram (kg)

☒ **B** newton (N)

☒ **C** newton kilogram (N kg)

☒ **D** newton per kilogram (N/kg)

(c) Which statement explains why the gravitational field strength on the Moon is less than the gravitational field strength on Earth?

(1)

☒ **A** the Moon is further away from the Sun than the Earth

☒ **B** the Moon has less atmosphere than the Earth

☒ **C** the Moon has less mass than the Earth

☒ **D** the Moon has a greater density than the Earth

(d) Describe the differences between the orbit of the Moon and the orbit of a comet.

You may include a diagram to support your answer.

(2)

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(Total for Question 1 = 5 marks)

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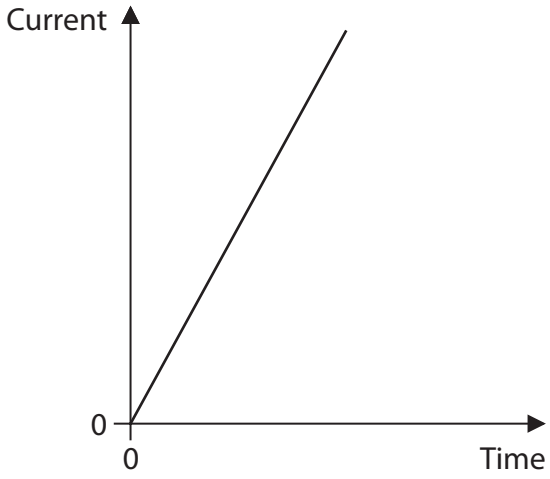
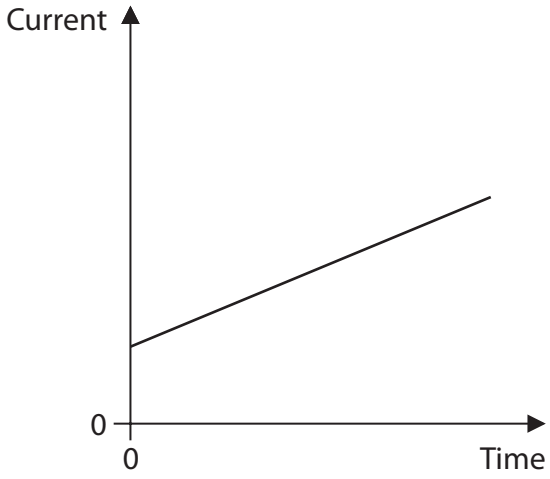
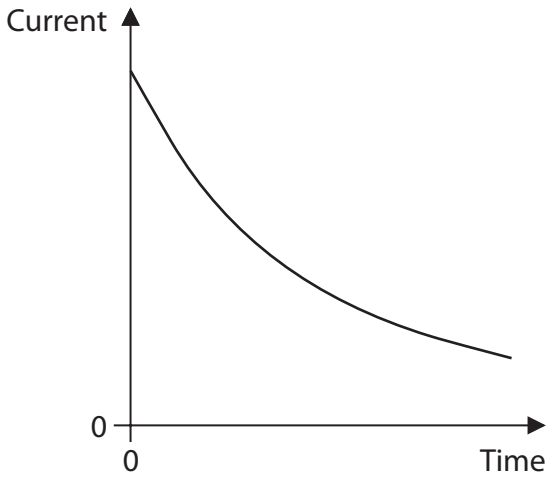
2 The diagram shows four graphs, P, Q, R and S. Each graph shows a different relationship between current and time.



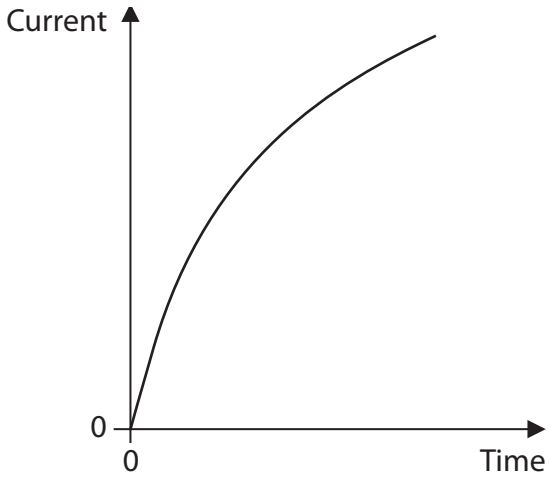
Graph P



Graph Q



Graph R



Graph S

The table gives descriptions of the relationships between current and time shown by graphs P, Q, R and S.

Complete the table by giving the correct graph for each description.

Description	Graph
current directly proportional to time	
current increasing at a decreasing rate	
current has a linear relationship to time but is not directly proportional	
current decreasing at a decreasing rate	

(Total for Question 2 = 4 marks)

3 This question is about microwave ovens and microwaves.

(a) A microwave oven cooks some food.

Diagram 1 represents a microwave emitted by the microwave oven.

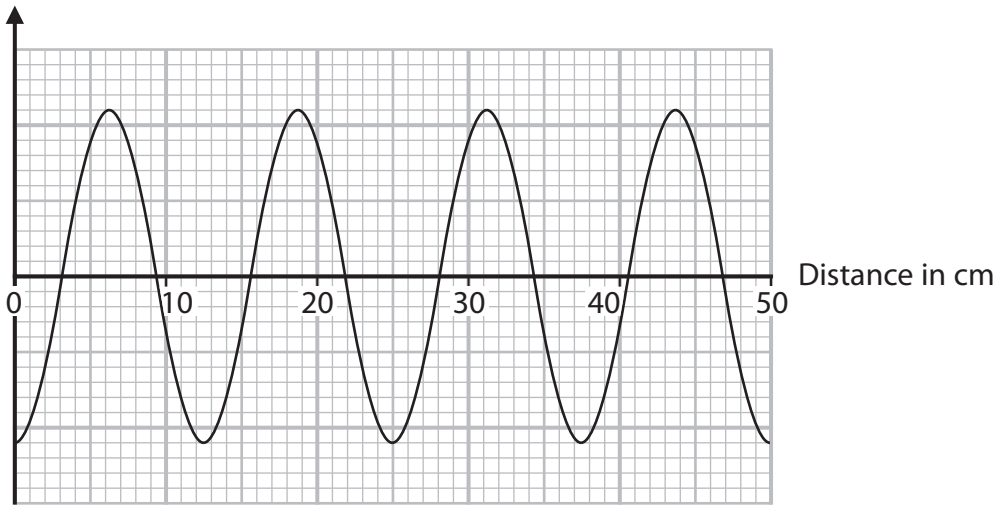


Diagram 1

(i) Determine the wavelength of the microwave.

(2)

wavelength = ... cm

(ii) The microwave has a frequency of 2.35 GHz.

Show that the speed of the microwave is about 3×10^8 m/s.

(3)

(b) Diagram 2 shows a damaged microwave oven with a hole in the door.

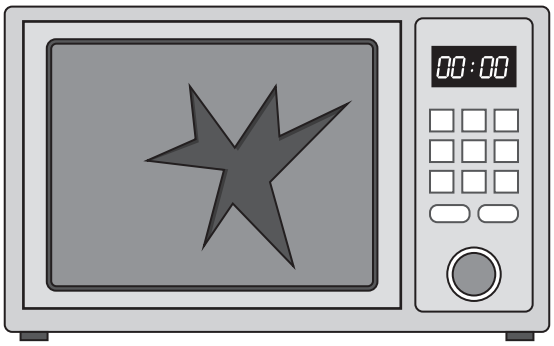


Diagram 2

This microwave oven should not be used as it is very dangerous.

State a harmful effect from the microwaves if this oven is used.

(1)

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(Total for Question 3 = 6 marks)

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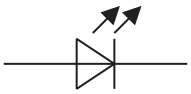
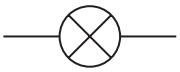
4 This question is about a filament lamp.

(a) Which of these is the correct circuit symbol for a filament lamp?

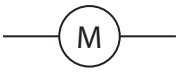
(1)



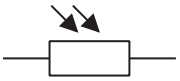
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(b) The filament lamp emits visible light.

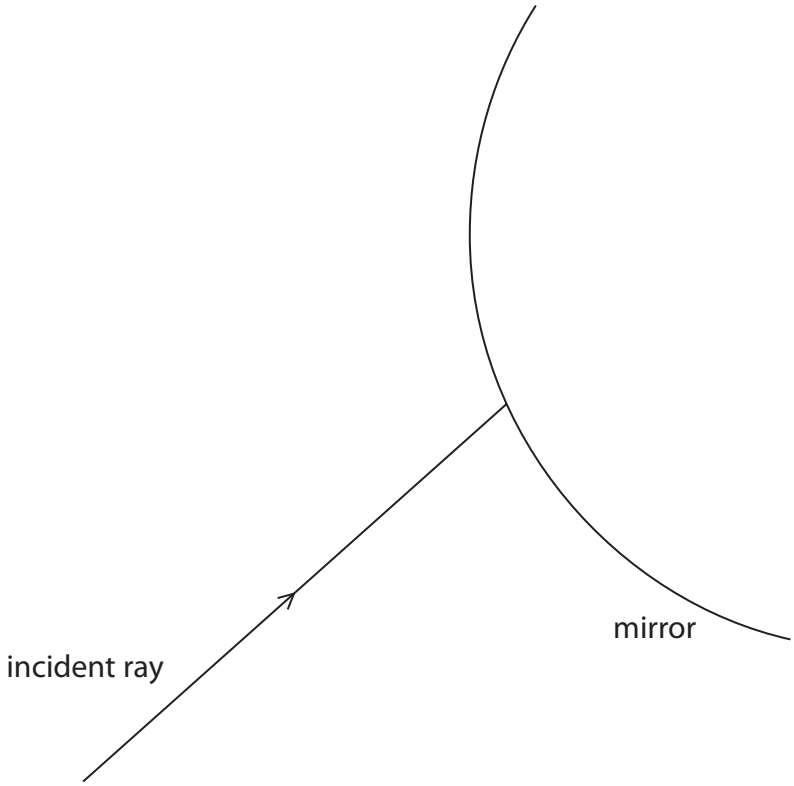
The table gives some statements about visible light.

Place ticks (✓) in the boxes to show which statements are correct for visible light.

(2)

Statements	Correct (✓)
visible light is a longitudinal wave	
visible light transfers energy	
visible light transfers matter	
visible light has a longer wavelength than x-rays	
visible light travels faster in water than in air	

(c) The diagram shows a ray of light from the filament lamp incident on the reflective side of a curved mirror.



Complete the diagram by drawing

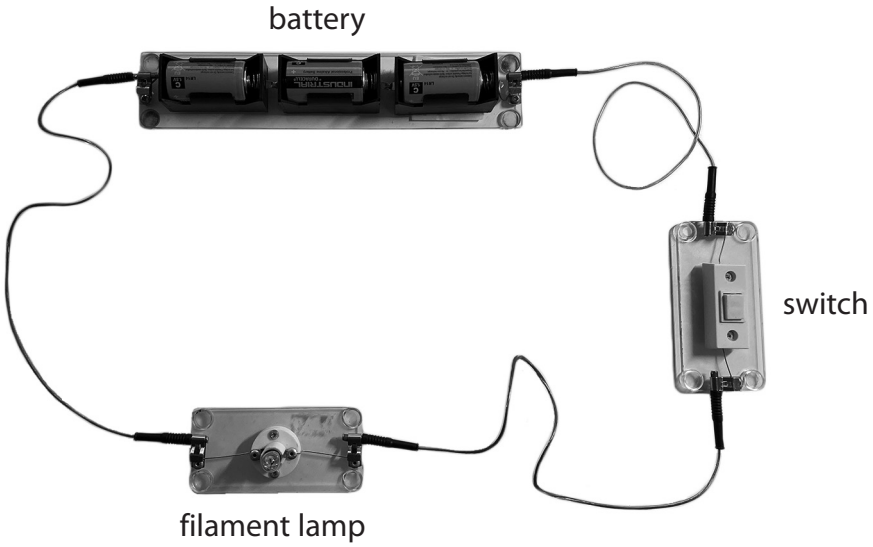
(i) the normal line where the ray is incident on the mirror.

(1)

(ii) the reflected ray of light.

(2)

(d) The filament lamp is connected in a circuit with a switch and a battery of three cells.



(i) When the switch is on, the filament lamp transfers 120 J of energy in a time of 3.0 minutes.

Each cell has a voltage of 1.5 V.

Calculate the current in the filament lamp.

(3)

current = ... A

(ii) A small plotting compass is placed near the wires in the circuit.

When the switch is turned on, the compass needle moves to a new position.

Give a reason why the compass needle moves.

(1)

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(Total for Question 4 = 10 marks)

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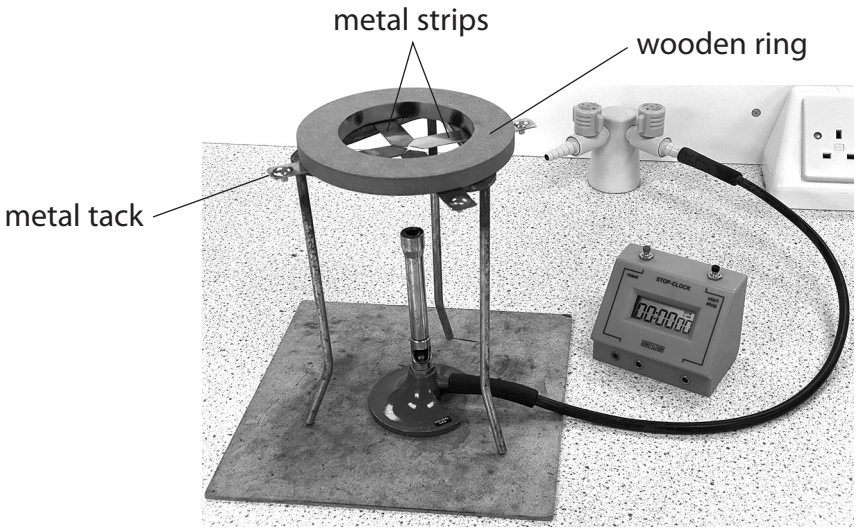
5 A student uses this apparatus to investigate energy transfer by conduction in metals.



This is the student's method.

- attach four strips, each made of a different metal, to a wooden ring
- use wax to attach a metal tack to the end of each metal strip
- place the strips above a Bunsen burner
- light the Bunsen burner and start a stopwatch at the same time
- when enough energy has been transferred to the wax, it melts, causing the metal tack to fall
- record the time taken for each tack to fall

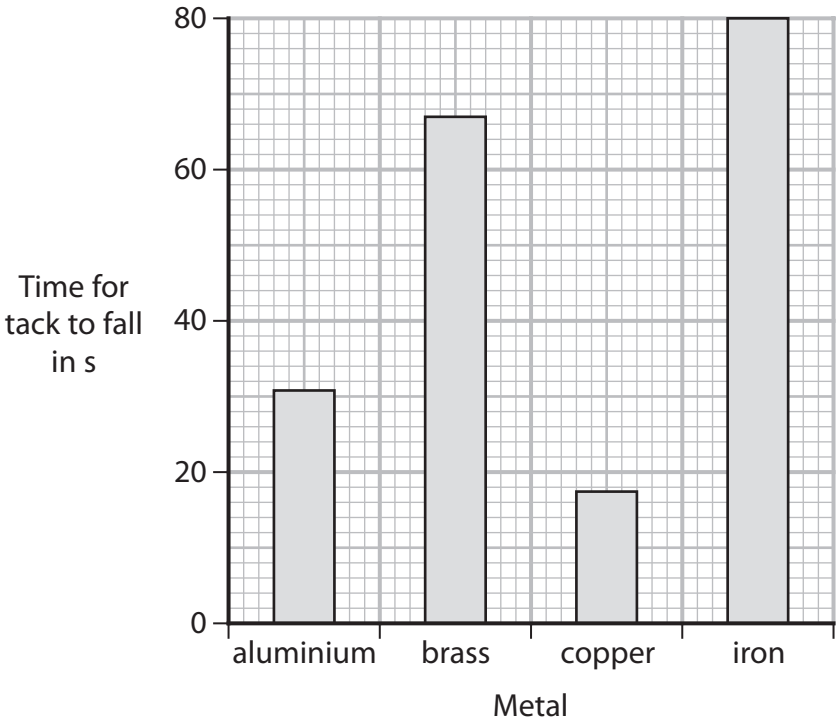
(a) Explain how the wooden ring makes the apparatus safer for the student to use.

(3)

(b) Describe how energy is transferred by conduction through the metal strips.

(3)

(c) The bar chart shows the results of the student's investigation.



(i) Justify the use of a bar chart in this investigation.

(1)

(ii) State how the student could improve the reliability of their results.

(2)

(iii) The student concludes that iron is the best metal for transferring energy by conduction.

Evaluate the student's conclusion.

(2)

(Total for Question 5 = 11 marks)

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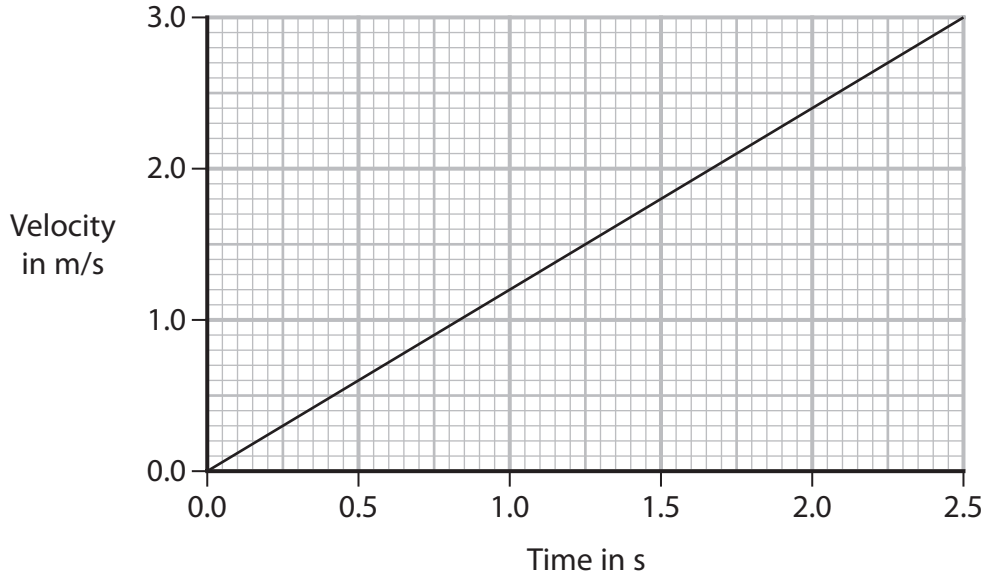
6 (a) The graph shows how the velocity of a ball rolling down a long ramp changes with time.



(i) Using the graph, calculate the acceleration of the ball.

(3)

acceleration = ... m/s^2

(ii) State the feature of the graph that gives the distance travelled by the ball.

(1)

.....

(iii) Calculate the distance travelled by the ball in 2.5 seconds.

(3)

distance = ... m

(b) The table shows data for the ball after it has travelled for two different times.

Time in s	Distance in m
5.0	15
10.0	60

A student suggests that these results obey the relationship:

$$\frac{\text{distance}}{\text{time}^2} = \text{constant}$$

Use data from the table to deduce whether the results support this suggestion.

(3)

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(Total for Question 6 = 10 marks)

7 This question is about using carbon dating to find the age of pieces of wood.

(a) The equation shows how carbon-14 forms in the atmosphere.

$$ {}^{1}_{0}n + {}^{14}_{7}N \rightarrow {}^{14}_{6}C + {}^{1}_{1}X $$

(i) State the name of particle X.

(1)

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(ii) Carbon-14 decays by beta decay.

State what happens to the number of protons and the number of neutrons in a carbon-14 nucleus when it decays.

(2)

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(b) A scientist determines how the percentage of carbon-14 remaining in a sample of wood changes with time.

The table shows the scientist's data.

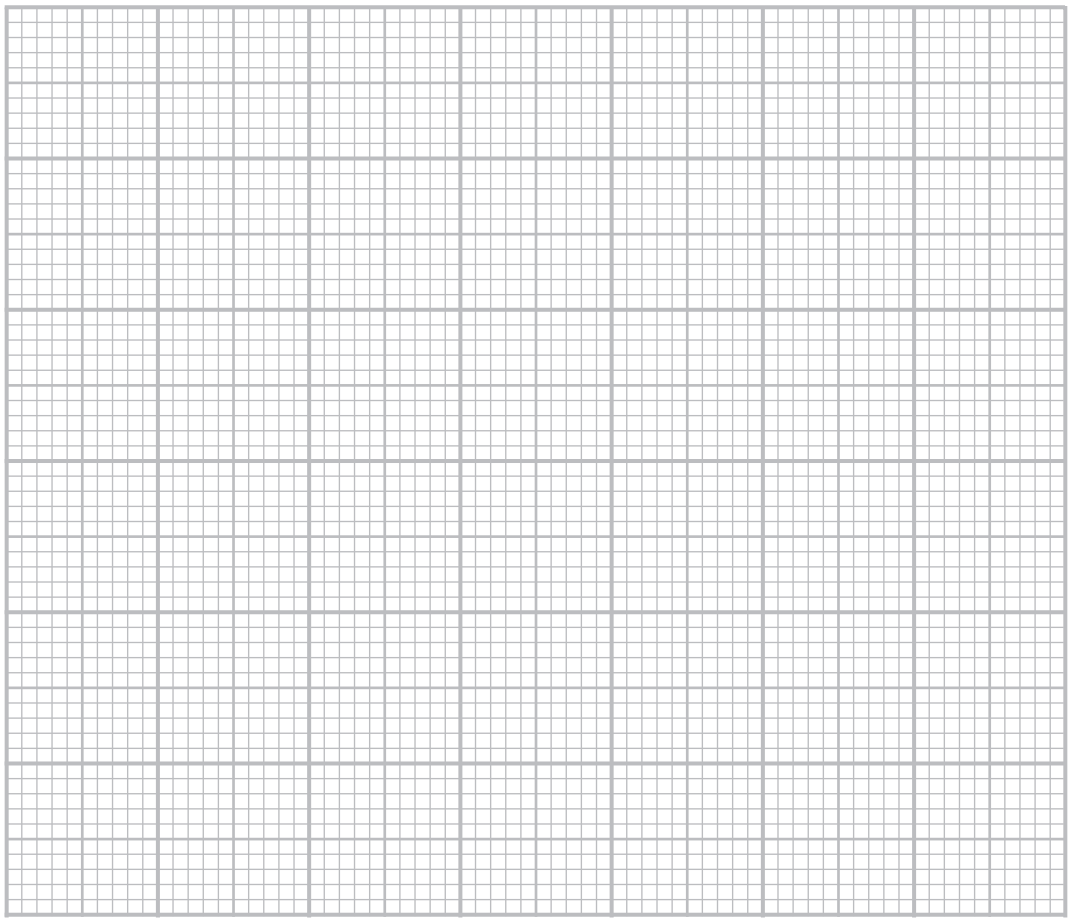
Percentage (%) of carbon-14 remaining	Age of sample in years
30	9900
40	7500
50	5700
60	4200
70	2900

(i) Plot the scientist's data on the grid.

(3)

(ii) Draw the curve of best fit.

(1)



(iii) Use the graph to determine the age of a sample of wood that has 36% of its carbon-14 remaining.

(2)

age = ... years

(c) Carbon-14 dating is inaccurate for samples of wood produced after 1950.

This is because the concentration of carbon-14 in the atmosphere greatly increased due to nuclear weapons testing.

(i) A tree absorbs carbon-14 during its lifetime.

A student suggests that trees grown after 1950 are contaminated with carbon-14.

Give a reason why the student's suggestion is correct.

(1)

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(ii) Explain how nuclear weapons testing affects the determination of the age of a sample of wood produced after 1950.

(2)

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(Total for Question 7 = 12 marks)

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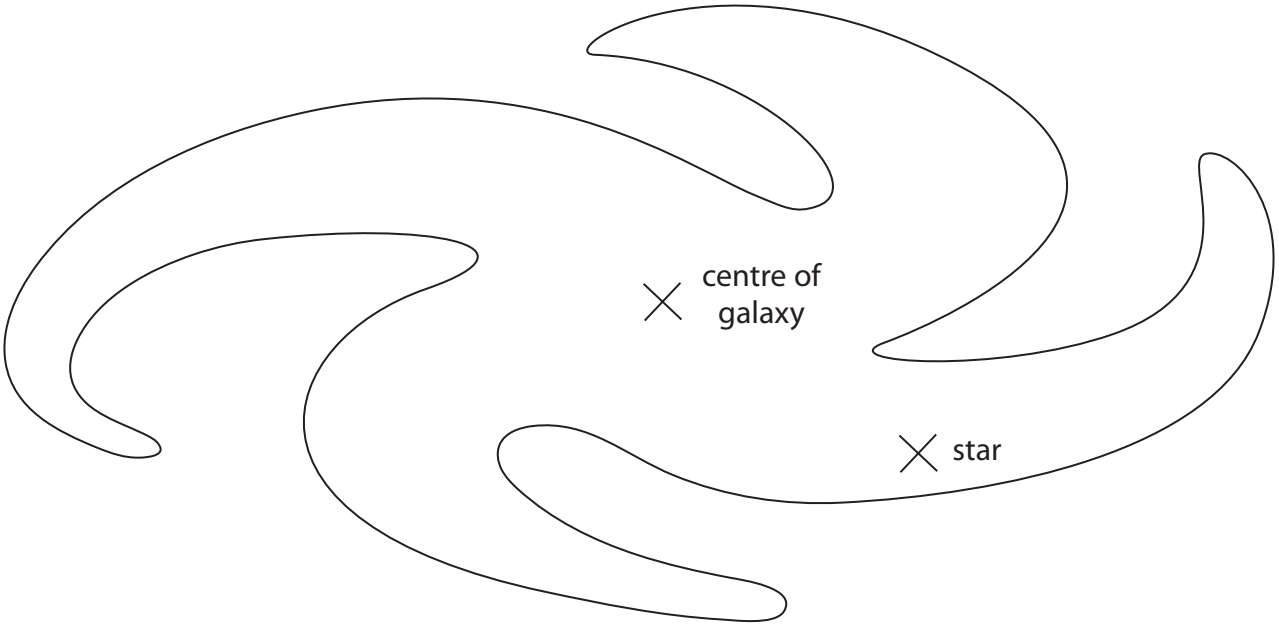
8 A star has a circular orbit around the centre of a galaxy.

(a) The diagram shows an outline of the galaxy and the star's position in the galaxy.



Draw an arrow on the diagram to show the force on the star that keeps the star in a circular orbit.

(1)

(b) (i) The speed of light is 3.0×10^8 m/s.

One light year is the distance light travels in one year.

Show that one light year is approximately 10^{16} m.

[one year = 3.2×10^7 s]

(2)

(ii) The star is 29 000 light years away from the centre of the galaxy and has an orbital speed of 220 km/s.

Calculate the time period of the star's orbit around the centre of the galaxy.

Give your answer in standard form.

(3)

time period = ... s

(Total for Question 8 = 6 marks)

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9 Diagram 1 shows some of the stages of electricity generation in a nuclear power station.

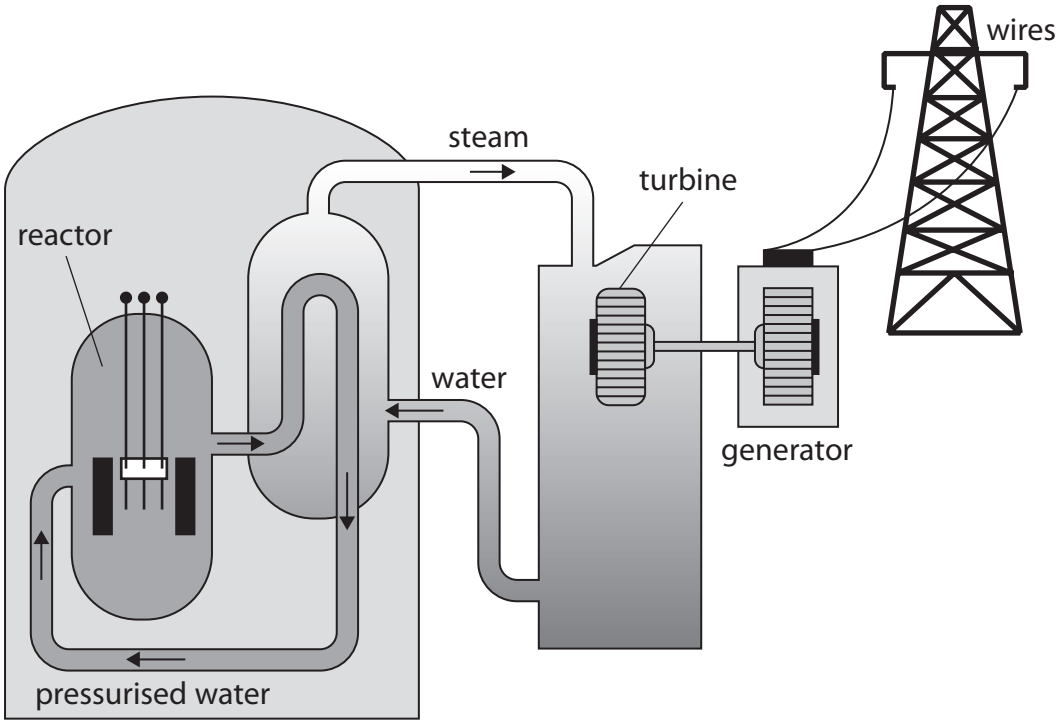

Diagram 1

(a) Nuclear fission takes place inside the reactor of the nuclear power station.

(i) Give the name of a fuel that could be used in the reactor.

(1)

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(ii) Energy is released from the fuel in the reactor by nuclear fission.

Describe the process of nuclear fission that takes place inside the reactor.

(4)

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(b) High pressure steam transfers energy from the reactor to a turbine.

The turbine spins as the steam passes through it.

Diagram 2 shows a simplified generator connected to the turbine.

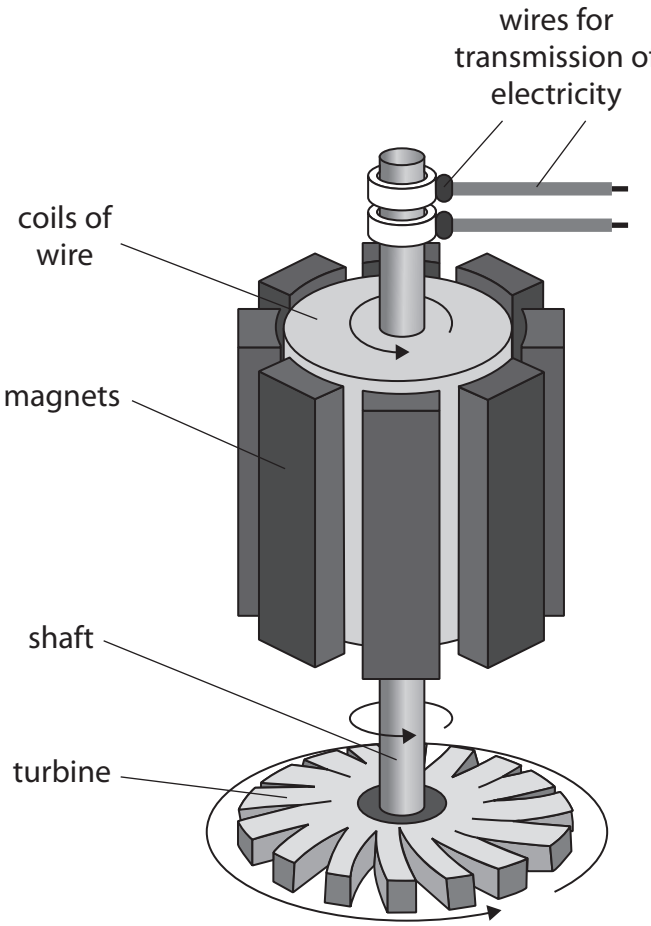

Diagram 2

(i) Explain how electricity is generated by the generator.

(3)

(ii) At night the power station does not need to generate as much electricity.

Suggest how the output of this generator could be reduced.

(1)

(iii) The generator produces alternating current.

Describe the differences between alternating current (a.c.) and direct current (d.c.).

(2)

(Total for Question 9 = 11 marks)

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10 This question is about electrical resistors.

(a) Diagram 1 shows a 13 kΩ resistor connected to a 5.8 V battery.

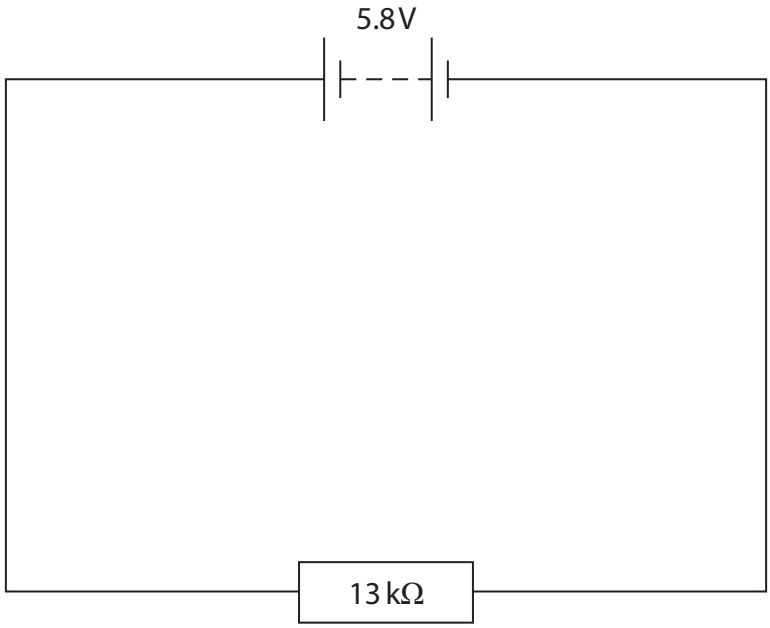


Diagram 1

(i) State the formula linking voltage, current and resistance.

(1)

(ii) Calculate the current in the resistor.

(3)

current = ... A

(b) Diagram 2 shows a 200 Ω resistor connected in parallel with a 13 kΩ resistor.

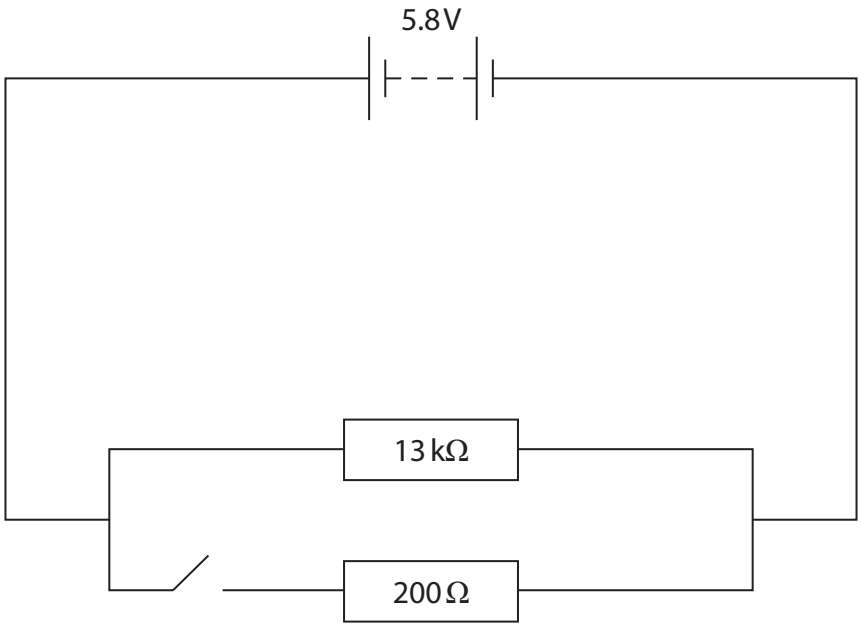


Diagram 2

(i) Complete the circuit diagram by adding a suitable meter to diagram 2 to measure the current in the 13 kΩ resistor.

(1)

(ii) The switch in the circuit is closed.

Explain what happens to the current in the 13 kΩ resistor and the current in the battery.

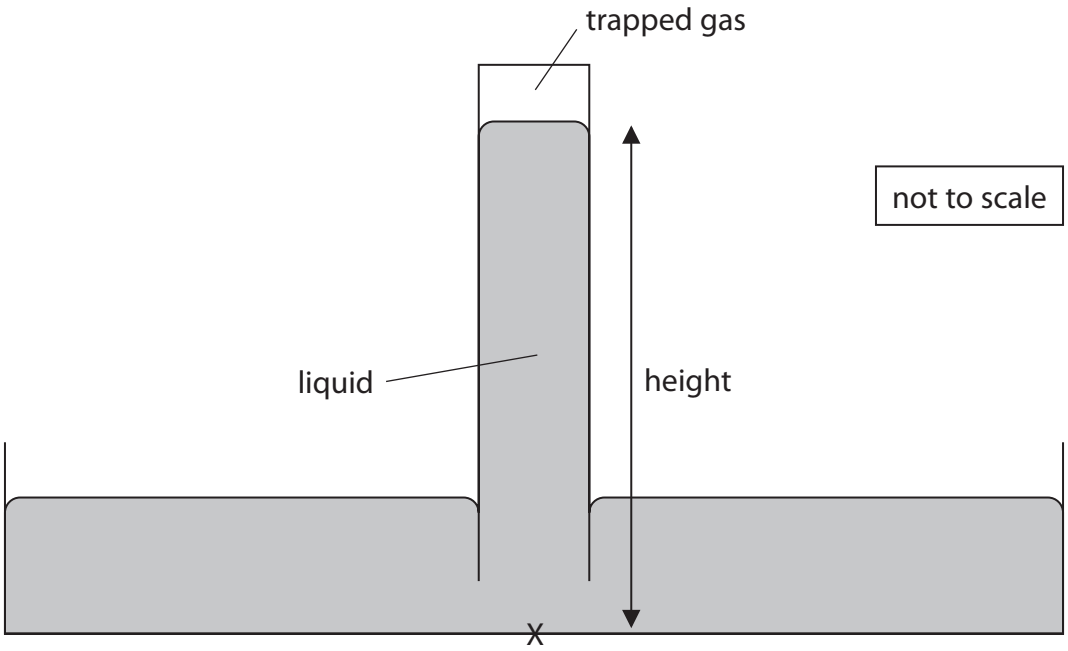
(5)

13 kΩ resistor

battery

(Total for Question 10 = 10 marks)

11 The diagram shows a simple barometer designed to measure atmospheric pressure.



(a) (i) State the formula linking pressure difference, height, density and gravitational field strength, *g*.

(1)

(ii) The total pressure at point X is 117 kPa.

The pressure of the trapped gas is 12 kPa.

Calculate the height of the liquid above point X.

[density of liquid = 1.36×10^4 kg/m^3]

(4)

height = ... m

(b) The Sun shines onto the barometer, increasing the temperature of the trapped gas.

The volume of the trapped gas remains constant.

(i) Explain why the pressure of the trapped gas increases as its temperature increases.

(3)

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(ii) The temperature of the trapped gas increases from 23 °C to 38 °C.

The pressure of the trapped gas is 12 kPa when its temperature is 23 °C.

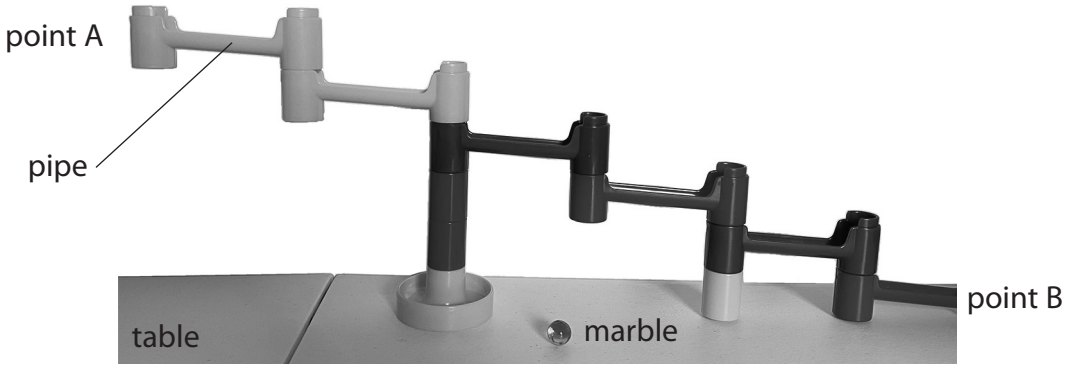
Calculate the pressure of the trapped gas when its temperature is 38 °C.

(4)

pressure = ... kPa

(Total for Question 11 = 12 marks)

12 The photograph shows a toy called a marble run.



A student lifts a marble from the table to the top of the marble run at point A. They release the marble from point A and it rolls through pipes to reach the bottom of the marble run at point B.

The marble leaves the marble run at point B and rolls across the table.

As the marble rolls, energy is transferred due to the different forces acting on the marble.

(a) Describe the energy transfers from before the student lifts the marble to when the marble reaches point B of the marble run.

(5)

(b) The student wants to measure how much energy the marble loses as it moves from point A to point B.

(i) The student needs to measure the speed of the marble as it leaves the marble run at point B.

Describe a method the student could use to measure this speed.

(3)

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(ii) The difference in height between point A and point B is 0.21 m.

The mass of the marble is 5.5 g.

The marble leaves the marble run at point B with a speed of 0.76 m/s.

Calculate the energy lost by the marble as it rolls from point A to point B.

(5)

energy lost = ... J

(Total for Question 12 = 13 marks)

TOTAL FOR PAPER = 110 MARKS

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Pearson Edexcel International GCSE (9–1)

Thursday 16 November 2023

Paper reference **4PH1/1P 4SD0/1P**

Physics

UNIT: 4PH1
Science (Double Award) 4SD0
PAPER: 1P

Equation Booklet

Do not return this Booklet with the question paper.

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P 7 3 4 2 7 A

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These equations may be required for both International GCSE Physics (4PH1) and International GCSE Combined Science (4SD0) papers.

1. Forces and Motion	
average speed = $\frac{\text{distance moved}}{\text{time taken}}$	
acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{(v-u)}{t}$
(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)	$v^2 = u^2 + (2 \times a \times s)$
force = mass × acceleration	$F = m \times a$
weight = mass × gravitational field strength	$W = m \times g$
2. Electricity	
power = current × voltage	$P = I \times V$
energy transferred = current × voltage × time	$E = I \times V \times t$
voltage = current × resistance	$V = I \times R$
charge = current × time	$Q = I \times t$
energy transferred = charge × voltage	$E = Q \times V$
3. Waves	
wave speed = frequency × wavelength	$v = f \times \lambda$
frequency = $\frac{1}{\text{time period}}$	$f = \frac{1}{T}$
refractive index = $\frac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$	$n = \frac{\sin i}{\sin r}$
$\sin(\text{critical angle}) = \frac{1}{\text{refractive index}}$	$\sin c = \frac{1}{n}$

4. Energy resources and energy transfers	
efficiency = $\frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$	
work done = force × distance moved	$W = F \times d$
gravitational potential energy = mass × gravitational field strength × height	$GPE = m \times g \times h$
kinetic energy = $\frac{1}{2}$ × mass × speed^2	$KE = \frac{1}{2} \times m \times v^2$
power = $\frac{\text{work done}}{\text{time taken}}$	$P = \frac{W}{t}$
5. Solids, liquids and gases	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
pressure difference = height × density × gravitational field strength	$p = h \times \rho \times g$
$\frac{\text{pressure}}{\text{temperature}}$ = constant	$\frac{p_1}{T_1} = \frac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
8. Astrophysics	
orbital speed = $\frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$	$v = \frac{2 \times \pi \times r}{T}$

The equations on the following page will only be required for International GCSE Physics.

These additional equations may be required in International GCSE Physics papers 2P and 2PR.

1. Forces and Motion	
momentum = mass × velocity	$p = m \times v$
force = $\dfrac{\text{change in momentum}}{\text{time taken}}$	$F = \dfrac{(mv - mu)}{t}$
moment = force × perpendicular distance from the pivot	
5. Solids, liquids and gases	
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta T$
6. Magnetism and electromagnetism	
relationship between input and output voltages for a transformer	$\dfrac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \dfrac{\text{primary turns}}{\text{secondary turns}}$
input power = output power	$V_p I_p = V_s I_s$ for 100% efficiency
8. Astrophysics	
$\dfrac{\text{change in wavelength}}{\text{reference wavelength}} = \dfrac{\text{velocity of a galaxy}}{\text{speed of light}}$	$\dfrac{\lambda - \lambda_0}{\lambda_0} = \dfrac{\Delta\lambda}{\lambda_0} = \dfrac{v}{c}$

END OF EQUATION LIST